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THE PROPOSED BOSTON-WASHINGTON SUPER-POWER LINE

By N. C. GROVER
Of the United States Geological Survey

William Spencer Murray, consulting engineer, of New York, has suggested that a super-power transmission line be constructed from Boston to Washington interconnecting at a voltage of 150,000 or more the principal steam and water-power plants, both old and new, with the principal power markets of the region. The suggestion is receiving the most favorable consideration by engineers, power companies, and power users. Franklin K. Lane, prior to his resignation as Secretary of the Interior, recommended a Congressional appropriation for an investigation of the project, to include estimates of costs and benefits.

The conditions which have led to Mr. Murray's suggestion are of such great importance to the region, and indeed to the nation, that they can not be overlooked. The demand for energy for industrial use is steadily increasing; the railroads are so congested with freight that disastrous delays in the delivery of coal are always imminent; the price of coal is steadily advancing; the Pittsburgh and Pocahontas fields which yield the cheap steaming coal of the Atlantic seaboard, are approaching exhaustion; the very life of the industries of the Northeast is threatened.

The increase in energy required by industries and public utilities and in transportation is disclosed by statistics of installed capacity of power plants collected by the Bureau of the Census at five-year intervals and corroborated by statistics of output of electrical power by public utilities collected monthly by the United States Geological Survey and by statistics showing the increasing annual production of bituminous coal, collected also by the Geological Survey. During the war the shortage of energy for the production of war materials was made apparent by the difficulties in obtaining fuel for domestic use; by the closing of stores, schools, churches, places of amusement, and even of industrial establishments engaged in producing "non-essentials;" by the prohibition of the use of illuminated advertising signs; and by the restriction on both

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PIERCE HALL, HEADQUARTERS OF THE HARVARD ENGINEERING SCHOOL

THE HARVARD ENGINEERING SCHOOL

The Harvard Engineering School which was opened to students in 1919, though new in name is in fact a re-establishment at the University of professional instruction in engineering and mining. This step was made necessary by the decision of the Court that the University could not legally use the income from the Gordon McKay Endowment to carry out the agreement made with the Massachusetts Institute of Technology in 1914. Under this agreement the University departments of engineering and mining moved to the Institute with their laboratory equipment, and for several years carried on their work in co-operation with the departments of mechanical, electrical, mining, civil and sanitary engineering at the Institute.

At the time the agreement was made the Harvard departments of engineering and mining were graduate schools, but the newly reorganized school has four-year undergraduate programs leading

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THE NEXT STEP IN INDUSTRIAL MANAGEMENT

By ERWIN H. SCHELL
Professor of Business Management, M. I. T.

In every manufacturing industry is a group of men, sometimes termed production executives whose duty is to convert raw material into finished product by means of the application of mechanical and human forces, the first being made available through the operations of machinery and the second through the operations of labor.

Formerly these men constituted a much larger part of the administrative organization than at present and they shouldered many other responsibilities. They obtained and stored the necessary materials and supplies, repaired their machinery, tested the finished product, obtained and trained the necessary labor and performed similar activities which were essential to the conduct of the business.

Gradually, however, these duties which were attendant to those of production were transferred to specialists who served in a functional capacity, that is to say, undertook to carry on a certain activity for the good of the entire plant. The purchasing agent agreed to obtain all of the necessary materials, machinery and supplies, the storekeeper to receive them, store them and distribute them to the production departments when needed, and later to accept the finished product and send it to the consumer. The plant engineer undertook to install all machinery, to see that it was equipped with a sufficient supply of power, and to keep it in such condition that breakdowns would be minimized. He perhaps also agreed to keep the buildings clean, sanitary and in proper working condition with satisfactory lighting, heating and ventilation.

At about this stage of development the production executives set about to further strengthen their own methods of operation. A designing department was installed so that orders could be more clearly expressed and standardized in terms of dimensions, and quality of workmanship. An inspector was appointed to see that these quality orders were carried out, and a planning department was later developed to determine how, when and

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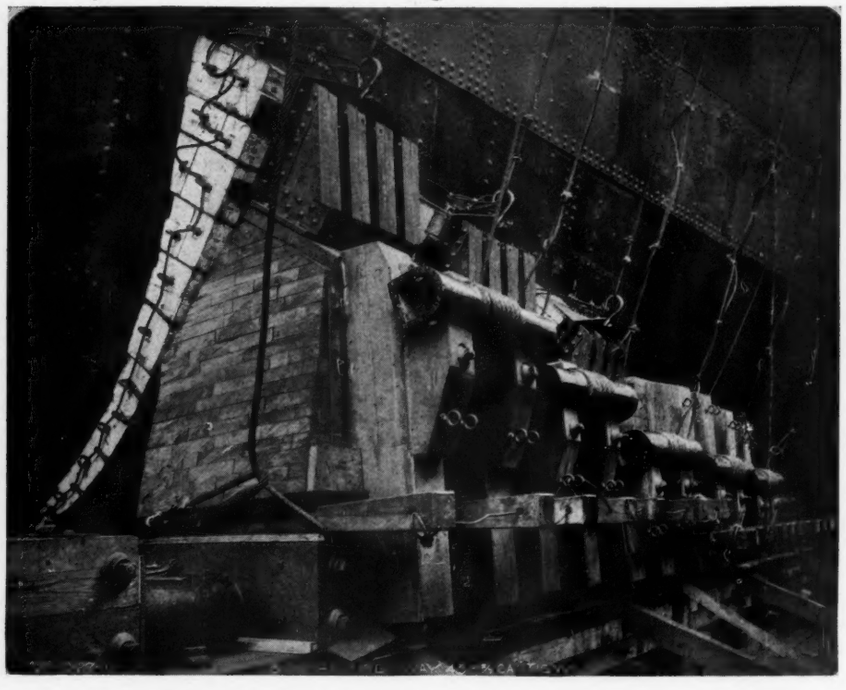
HOG ISLAND LAUNCHING METHODS

By WILLIAM FORTUNE
General Superintendent Hull Assembly at Hog Island

In order to give an understanding of the launching gear and methods used for launching the ships constructed at Hog Island it will be well to give a brief description of the construction of the ground ways, sliding ways, and cradle. These three main parts of the launching structure may be clearly seen in the preceding photograph showing the Port Bow packing Ways as installed for the launching of the "B" Type 8,000 ton United States Army Transport "Cantigny." The gear used for launching the "A" Type or 7,825 ton cargo boats built in this yard is essentially the same as shown in the photograph; the only difference being that as the "A" ships are more full in form of hull,—the packing and the frappings, or lashings, which prevent the packing from spreading from the weight of the boat are lighter in construction and of less extent longitudinally.



BOW PACKING-WAY

Referring to the photograph the ground ways may be seen crossed by the name "Cantigny." The ground ways are the fixed members of the launching gear and form the track on which the cradle supporting the ship slides down the ways. These ways are made of heavy timber bolted together to form a section about 12 inches thick and 48 inches wide. The top surfaces of these ways are shod with oak planks about 3½ inch. thick. On the outside edge of the ground ways are bolted planks called the "ribbands" which act as guards to prevent the sliding ways from running off the ground ways.

There are, of course, two sets of ground ways which are spaced about 20 feet apart, depending upon the size and beam of the ship, and set at a declivity of 11-16 inches to the foot.

After the ground ways have been placed in position beneath the hull to be launched, they are coated with stearine about ⅛ of an inch thick and upon top of this searine is placed a coat of grease composition about ⅜ of an inch thick. At intervals along the length of the ground ways there are placed spacer bars of steel ¾ of an inch thick laying transversely across the ways to take the weight of the sliding ways and to prevent them from forcing the grease away before the launching time,—these bars being removed previous to setting up on the wedges between the sliding ways and packing, or about 40 minutes before launching.

The sliding ways are built in a similar manner to the ground ways and are also shod with oak planks. These sliding ways may be seen in the photograph of the bow of the "Cantigny," indicated by the steel facing used as a bearing surface for the jacks if necessity for their use in starting the boat occurs. It may be said here that Hog Island to date 98 boats have been launched and these jacks (although always placed as a safety precaution) have never been used.

Upon the sliding ways and bearing against the bottom of the ship—clearly seen in the photograph—so shaped as to accommodate itself to the form of the hull, a cradle or packing is built. Between this packing and the top of the sliding ways are placed wedges which are used to set the packing snugly against the hull of the vessel, and this is the only purpose for which these wedges are used at Hog Island.

In the launching methods used at practically every other yard in the country, these wedges however are used for another more important purpose; that is of actually transferring a portion of the weight of the vessel from the keel and bilge blocks upon which it is constructed to the sliding ways making it easier to split out these blocks and throwing the whole weight of the vessel first on the packing, then to the sliding ways and finally on to the grease and ground ways. This method while of long standing and almost universally used has in it a very serious danger; that is of allowing the entire weight of the vessel to be supported entirely by the grease for a very considerable length of time; sometimes two or three hours, and sometimes squeezing the grease completely out from between the ways and resulting in an unsuccessful launching. This difficulty has been eliminated at Hog Island by the use of sand jacks, which will be hereafter described in more detail.

Again referring to the photograph of the gear of the "Cantigny" there will be seen crossed by the word "bow" a most important part of the launching gear,—the sole pieces which form the connection between the fixed or ground ways and the sliding ways and holding the cradle and vessel in place until it is time for launching. These sole pieces are made of heavy oak planks bolted at one end to the ground ways and again bolted at the other end to the sliding ways, and at the time of launching they are sawed in two allowing the ship suported upon the sliding ways and packing to slide down the ground or fixed ways into the water.

As a safety measure, in case the sole pices should break or tear themselves from their fastenings, there is placed at the aft end of the ways "dog shores" which are struts diagonally placed—one and against the sliding ways and the other against the piling of the shipway. The "dog shores" are left in place until immediately before the sawing of the sole

STERN PACKING-WAY

pieces and until all of the launching crew are in a position of safety.

The description given above is of a general nature and is true of the launching gear used at practically every shipyard with the exception of the sand jacks.

As there were 110 boats of the "A" Type, identically the same in all particulars, to be launched at Hog Island unusual care was taken in the construction of the launching gear; every detail being worked out most carefully and every possible precaution being taken to insure safety in launching, particular attention being paid to the strength of the connections between the sections of the ways to insure against breakage, as accidents of this nature are not an infrequent occurrence in launchings.

For the launching of the 110 "A" Type boats five sets of packing were made and with these five sets of packing 91 boats have to date been successfully launched, without replacing any of the ways, packing, wedges or any other part of the launching gear with the exception of the sole pieces which, of course, must be renewed at each launching.

Seven (7) Army Transports or the "B" Type boats have been launched with one set of packing, and it is expected, because of the present condition of the launching gear which is almost in its original condition, that the entire 12 boats building and built at this yard will be launched with but six sets of packing.

There will be seen in the photograph of the "Cantigny" extending up the side of the boat the tag lines which are used to secure the ways to the vessel and for use in recovering them after launching. Extreme care has been used with these tag lines and the result has been that all of the launching gear has been saved after each launching, resulting in the saving of a very considerable sum of money.

The most important point of difference between ordinary launching methods and those used at Hog Island is in the use of sand jacks for transferring the weight of the vessel from the blocking upon which the ship rests during construction to the packing, sliding ways, and ground ways. During construction the weight of the vessel is supported upon timber keel blocks and bilge blocks, and the removal by splitting out with wedges of the timber blocks at the time of launching, due to the weight which rests upon them, always takes a very considerable length of time; ordinarily a period of at least from one and one-half to two and a half or even three hours; the weight of the vessel beginning to bear upon the grease as soon as the first ones are removed, and this weight of course increases until the entire weight of the vessel rests upon the grease. It sometimes takes a very considerable length of time to split out the last few blocks allowing unequal bearing of the weight of the vessel.

At Hog Island prior to launching time and while the rest of the launching gear is being placed the top piece of the bilge and keel blocking is removed and replaced by sand jacks which consist of hollow iron castings about 20 inches by 10½ inches by 6 inches deep, open at the top and filled with dry sand, upon which rests a block of oak of such size as to easily slide into the box. The sand is allowed at each end of the box. This is the final operation previous to dropping the "Dog Shores," sawing off the sole pieces and releasing the vessel. At a Hog Island launching by the use of these sand jacks the entire weight of the vessel is *evenly transferred from the keel and bilge blocks to the launching cradle in 27 seconds*, and it is probably due to the use of these sand jacks that of the Hog Island launchings have occurred without a hitch.

On Memorial Day, 1919, by the use of the sand jacks 5 "A" Type ships were launched in 48 minutes with one crew of men, and in addition the launching crew had to travel one and one-eighth miles from the launching of the first ship to the fifth. This would not have been possible without the use of the sand jacks, and was a World launching record.

In accordance with the unvarying successful rule of the executive management of the American International Shipbuilding Corporation in all operations and also of the officials of the United States Shipping Board stationed at Hog Island, the responsibility of launchings has been placed entirely on those in charge of the work and for this reason the greater part of the credit for the successful launchings at Hog Island is due to the management.

The American Internationl Shipbulding Corporation has presented to the Institute of Technology a model showing the vessel prepared for launching on the ways; one half size model of the sand jacks, and a complete set of drawings of the launching gear,—all these may be seen in the Department of Naval Architecture.

E. E. SMOKER

Mr. W. L. Emmet, consulting engineer of the General Electric Co., gave a very instructing and interesting talk to the electrical engineers on the afternoon of April 27th, on turbines. Mr. Emmet is largely responsible for the electrically propelled warships which were developed so much during the war. In reward for his work along this line Mr. Emmet will receive on the 21st of this month the 1919 Edison Medal, the highest honor conferred by the American Institute of Electrical Engineers.

AERONAUTICAL LECTURES

The lectures held under the auspices of the Aeronautical Engineering Society on Fridays at 4 o'clock in room 10-200 have proven very popular if the attendance is any criterion of success. Thus far they have been given by George M. Denkinger, '20, and the next two or three lectures will be given by him also. The lectures are open to all interested and are not of the type that hold forth in 10-250.

THE HARVARD ENGINEERING SCHOOL

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to a bachelor's degree, and in addition it offers graduate courses and opportunities for research, leading to the master's degree and the doctor's degree in all its departments.

There are at present nine programs of study, as follows: mechanical engineering, electrical engineering, electric communication engineering, civil engineering, municipal and sanitary engineering, sanitary chemistry, mining, metallurgy, and industrial chemistry.

The school has recently adopted a new plan of instruction whereby third-year students may obtain at least six months' engineering experience and industrial training. By using half of the second vacation and all of the third vacation, and by a re-arrangement of the third-year schedule, this outside work can be taken without increasing the period of time required for a degree and at the same time securing the full amount of regular classroom and laboratory instruction.

The buildings formerly occupied by the Engineering School were used during the war by the United States Navy as a school to train naval radio operators; and it was not until the end of June, 1919, that the buildings were given up by the Navy and made available for restoration. It was a large undertaking to renovate, rewire and re-pipe the buildings for laboratory purposes, build new foundations for the machinery, and move the apparatus from the Institute; but by the first of October when the new year began, the buildings were ready for use. Throughout the present year regular work has been carried on without interruption. The laboratories have been rebuilt and re-equipped, and are now in first-rate shape.

ELECTRICAL ENGINEERING LABORATORY IN PIERCE HALL

The buildings occupied by the school at present are: Pierce Hall, a four-story building which contains offices, class-room and drafting-rooms for engineering, the electrical laboratories, the sanitary laboratory, and a metallurgical laboratory; the Cruft laboratory, a three-story building equipped and used solely for wireless and other high-frequency electrical work; the Rotch Building which contains class-rooms and laboratories of mining and some of the metallurgical laboratories; and in addition a large new building called the Gordon McKay Engineering Laboratory which contains gas and steam engines, hydraulic and refrigerating machinery and material-testing equipment.

EDITOR'S NOTE:—The above was very kindly written by Professor Hughes, acting dean of the Harvard Engineering School, at the request of the Tech Engineering News.

THE ROTCH BUILDING—MINING DEPARTMENT

FACTORY JOB-TICKET CARRIERS

One of the efficiency devices used in most well-organized manufacturing institutions is the flexible card holder with transparent face for carrying the job ticket which travels with each job through the factory. These are somesometimes called job travelers. Without some protection from grease and from soiled hands of workmen, the job ticket soon becomes illegible and delays and mistakes occur.

The ideal flexible card holder is made with a back of leather substitutes or rubber coated cloth and a front of transparent sheeting. The back is turned over the edge of the sheeting and stitched down so as to make a pocket open at the top. This pocket is water, grease and stain proof, and the inside tag is legible all the time.

The flexible card holder pays for itself over and over again. These flexible card holders are sold by different concerns making factory equipment. They can also be very easily made. In some factories, they can be made entirely from scrap material.

A great many shops, particularly those in the automobile industry, use a great deal of leather substitute and transparent sheeting for automobile tops and curtains and they can make these card holders out of scraps. A leather substitute with a pyroxlin coating has proved to be better than a rubber coated cloth.

THE PRODUCTION OF SYNTHETIC NITRIC ACID IN GERMANY DURING THE WAR

By JAMES F. NORRIS

Professor of General Chemistry, M. I. T.

In recent years much attention has been given to the production of ammonia and nitric acid from the nitrogen of the air, on account of the fact that the available natural supply of these substances, which are used as plant foods in fertilizers, is rapidly being consumed. Nitric acid is the basis of all explosives and propellents used in warfare—a fact which had, no doubt, a marked effect on the great advances made, and led to the expenditures of large sums for experimentation by the governments of several countries. It is of interest to note that a large plant for the manufacture of nitric acid from the nitrogen of the air was completed at Oppau in Germany, about four months before the recent European war began. Without this plant it would have been impossible for Germany to continue at war after the supply of nitrate it held in storage had been exhausted, for the blockade prevented the importation of this essential war material from Chile.

The Oppau plant uses the method worked out by Haber, and produced nitric acid at a cost which it is claimed will compete with the acid made from Chile saltpeter. Haber's synthesis consists in the preparation of ammonia as the result of the union of nitrogen and hydrogen. To have the method a success cheap raw materials were necessary; and the ingenuity shown in solving this problem was as great as that displayed in working out the synthesis itself.

Nitrogen is present in the air in unlimited amounts, but mixed with oxygen. Hydrogen is in water, but is combined chemically with oxygen. Many methods are known by which the required gases can be obtained from these sources, but they were too expensive to use. Haber employed for this purpose carbon in the form of coal or coke—the cheapest substances that could be used. When air is passed over hot coke in a gas producer carbon monoxide is formed from the oxygen and the nitrogen is unaffected. When steam is passed over hot coke as in the process for making water gas, carbon monoxide and hydrogen are formed.

The next problem was to free these mixtures from carbon monoxide. As this gas is very inert chemically and could not be removed economically by dissolving it in a liquid, it was converted into carbon dioxide. This was accomplished by passing the mixture of nitrogen, hydrogen, and carbon monoxide along with steam over a hot catalyst. As a result of the action which took place between the monoxide and the steam, carbon dioxide and hydrogen were produced. The separation of the carbon dioxide from the other gases was affected by dissolving it in water at a pressure of fifty atmospheres. This method required power, and added thus to the expense, but an ingenious inventor conceived the plan of passing the carbon dioxide which escaped from solution when the pressure was released through a turbine engine. As a result, a large part of the energy consumed in compressing the gases was recovered as power, and utilized in the compression of a new portion of the original gases.

The mixture of nitrogen and hydrogen was next freed from traces of impurities, and, after compression to 200 atmospheres, was circulated over a catalyst where the temperature was maintained at about 500° C. by the heat produced in the reaction. As ammonia was formed it was dissolved in water.

To prepare nitric acid, the ammonia was passed along with air over a catalyst. The nitric oxide formed was cooled, mixed with air, and introduced into towers containing water, where it was converted into nitric acid.

The plant at Oppau is said to have produced ammonia equivalent to 200,000 tons of nitric acid per year. During the stress of war a larger plant was constructed near Halle. These two sources will be able to furnish all the ammounia and nitric acid required by Germany during times of peace.

Representatives of the allied governments had an opportunity to study the plant at Oppau during the armistice, but the Germans had taken the precaution to remove the catalysts before the occupation by the French. As the success of the various steps the process is dependent on the catalysts, much investigation must be carried out before the method can be used by others than the Germans.

RESEARCH ON DRAFT TUBES FOR WATER TURBINES

Under the direction of Professor G. E. Russell, graduate students are conducting experiments in the Research Department of the Hydraulic Laboratories on the design of draft tubes for water turbines. It is known that a good design of draft tube will increase the efficiency of a turbine, but there is a lack of knowledge regarding the relation between the length of tube, angle of flare, and velocity of flow in an efficient draft tube flowing full. It is the purpose of these experiments to gain a complete knowledge of these relations.

THEORY CONNECTS AURORA BOREALIS WITH SUN SPOTS

That the Aurora or the flickering patches of light which wave in the sky are caused by the bombardment of the earth by the tattered fragments of some great eruptive prominence or sun-"spot" which was driven out from the sun some two or three days previous, is the new theory of Dr. Lindermann.

Careful record shows that sun-spots must be connected with auroras in some manner, and are also coupled with the so-called "magnetic storms" that cause intermittent deviations of the surveyor's needle—since both occur most frequently when there are sun-spots near the center of the sun's disk, directly facing the earth, or when the spot is a little past the center.

Dr. Lindermann states that when the single electron of the hydrogen atom is momentarily displaced from its orbit, as may be done by bombardment with the ultra-violet rays of the sun, it absorbs light which it radiates upon slipping back into its orbit. This light corresponds to one of the lines of the hydrogen spectrum. This out again, in again and accompanying flashing continues at the sun's surface or near it, until finally the electron and nucleus by the right combination of kicks from light rays are knocked to pieces and projected separately into space. They travel at a rate of about 500 miles per second—a rate that corresponds to the two day time lag which intervenes between the passage of the sun-spot across the center of the sun's disk and the magnetic storm and aurora here.

Suppose now that this stream of tattered fragments intersects the earth's orbit, and that the earth happened to pass through it. As they hit our atmosphere, the electrons, which are light, would be stopped by the very first traces of air, while the positive nuclei, which are much smaller and heavier, would penetrate to a considerable depth. Thus the extreme outside regions of the atmosphere would be negatively charged, while a layer nearer the earth's surface would receive a positive charge. The recombination of the two would produce the electric currents which are needed to account for the magnetic storms, while the passage of the positively charged corpuscles through the outer atmosphere would set it shining, like gas in a vacuum tube, with an electric discharge, and produce the aurora.

There are still some rather puzzling details about the theory which will require considerable time and study before they are solved, but in its main outline it appears to be as reasonable as it is beautiful. —*Condensed from the Scientific American.*

TECHNOLOGY MEN AT MUSCLE SHOALS

By WILLIAM BENJAMIN WEST, B. S., Alabama Polytechnic Institute, '18

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It is a well known fact that graduates of the Massachusetts Institute of Technology not only played an important part in the world war but that they were also connected with some of America's greatest war industries. In the case of the Hog Island Shipyard, for instance, it is said that several hundred Tech men were in the executive force during its construction. Indeed, some are there now helping to complete the shipbuilding program outlined for that yard at the beginning of the war.

As a matter of fact, Matt C. Brush, President of the American International Shipbuilding Corporation, is a graduate of the Massachusetts Institute of Technology in the Class of 1901. Other officials and promoters of that great enterprise are former Tech men.

While the writer does not purpose to take up here in detail the many war industries with which Tech men were connected, yet it is safe to say that no college in the land can boast of having more men in responsible executive engineering positions in industries during the conflict than the Massachusetts Institute of Technology. Other institutions of learning may have had more men in the army than Tech; other colleges may stand higher in athletics than she does yet when one begins to turn through the pages of "Who's Who" in the engineering world, it is safe to say that the name of "Technology" will be ever before his eyes.

It is fitting, therefore, that we should note the number of Tech men in executive positions at one time or another at the great government enterprise at Muscle Shoals, Alabama. Here we have examples of every form of engineering, civil, chemical, mechanical, electrical and their various branches.

THE WILSON DAM

The Wilson Dam which is now under construction at Muscle Shoals will have, when completed, the largest volume of any masonry dam in America. After making a careful search in engineering literature and records, the writer finds that it will be the largest in the world except the Assuan Dam across the Nile River in Egypt and possibly the Vyrnwy Dam in England. The two former are of exactly the same height; the Wilson Dam will be somewhat longer, while all will have very nearly the same volume.

In comparing the Keokuk Dam of the Mississippi River Power Company with the Wilson Dam as it is to be when completed we find that while the former is over four thousand feet long and fifty-three feet high, by twenty-nine feet wide on top and forty-six feet wide at the bottom, the Wilson Dam will also be considerably over four thousand feet long and will be over ninety-six feet wide at the bottom. Thus it is seen that the Wilson Dam will contain considerably more masonry than the Keokuk Dam. The Keokuk Hydro-electric Development is generally acknowledged to be the largest in the world.

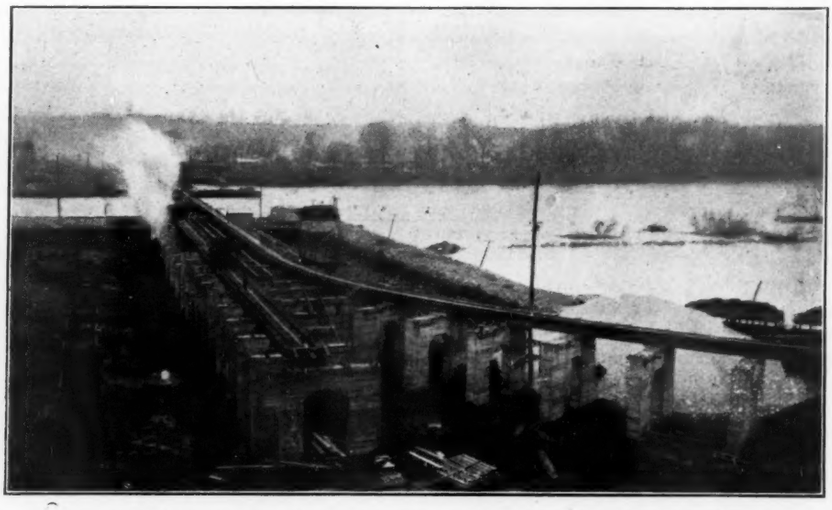
The famous Quaker Bridge Dam in New York is over thirteen hundred feet long and two hundred seventy feet high, but is much more lean in sectional dimensions. The Roosevelt Dam does not come in its class at all for this dam is very short and high. It is therefore, seen that the Wilson Dam will actually be the largest dam in America.

Not only will the construction of the Wilson Dam make the Tennessee River a very valuable waterway and enable the nitrate plant to be operated for the manufacture of fertilizers, but it will also provide cheap power for other industries that may want to locate at a desirable place where labor conditions and transportation facilities are so well adapted to such as at Muscle Shoals. Muscle Shoals is situated approximately midway between Memphis, Nashville, Chattanooga and Birmingham. The general local conditions which influence the methods and time of construction of the dam are especially good. The river is of great service in bringing in construction materials, and electric power is available for construction purposes at reasonable cost. Power at present is furnished by the Alabama Power Company from their Lock 12 hydro-electric development and the Warrior River Steam plant. The former being 140 miles away, while the latter is 90 miles south of Muscle Shoals. It is interesting to note that this Warrior River plant is in the very heart of Alabama's coal mines; being at the very mouth of some of the mines on the banks of the Warrior River. Power is supplied from these plants over a single circuit, three phase stranded copper transmission line. The cables are each one-half inch in diameter and are in a horizontal plant.

WATER POWER

It seems that the great importance of hydro-electric development in Alabama and other parts of the Union should have long since stirred up not only their state legislature, but also our national congressmen to the necessity of proper legislation in this regard. While the importance of the development of our water power has been time and time again emphasized by men who are leaders in the world's affairs, yet this is an opportune time to think a little more seriously of the matter which is of such importance to our industrial supremacy.

With our railroads tied up by strikes from time to time, with our people going cold for want of coal and fuel, it is apparently about time for us as American people to awaken to assert ourselves in some way against our allied enemies (in a way)—labor and capital.



THE WILSON DAM UNDER CONSTRUCTION AT MUSCLE SHOALS LOOKING SOUTH

HYDRO-ELECTRIC DEVELOPMENT THE SOLUTION

With a fuller development of our water-power and the electrification of at least our trunk line railways, we will have gone a long way in the direction of solving the very aggravating strike menace. In the first place, it does not require near so many people to operate a hydro-electric plant as a steam plant. Then too, when hydro-electric energy is used instead of steam generated power, thousands of railroad cars are relieved for other purposes and the miners who were digging coals for the power plant will not be able to cause a general shut-down by simply quitting work. The very closing of a switch at an automatic hydro-electric plant is the one act necessary to supply thousands of horse-power for industrial purposes.

America's finest engineers are now advocating a "super-power plan." That is, linking all large cities on our eastern coast up by means of a high voltage transmission line so as to permit the more efficient operation of all power plants in the district served by this line. The line would, therefore, act as a great "equalizing bar." That is, a power plant in New York would be able to instantly supply power to a plant in Philadelphia or Boston or Washington in case of a sudden overload or disaster and vice versa. Then too, this would make possible the marketing of hydro-electric energy generated in Pennsylvania, New York state and New England, in New York City, Philadelphia, Boston, Providence, and elsewhere, thus closing down numbers of steam plants now in operation all along the line. The 72,000 H. P. steam turbo-generator now in operation in the Interborough Rapid Transit Company's plant in New York, for instance, now requires 1200 to 1500 tons of coal per day for its operation. That is enough coal to supply the families in a town of 1300 people with fuel for a whole year, assuming 5 tons per year, and five people per family. It is therefore clear that if this great machine could be supplanted by one of hydro-electric power, a great saving in our supply would be made. The 72,000 horse power steam turbine at Muscle Shoals is a duplicate of the above machine. The Government is, in this case, building a dam to supplant this machine with hydro-electric power. Surely, as soon as the necessary legislation is enacted, capital will be available for the development of our water power. It is also hoped that those at Washington responsible for our present standing in the presence of the world at large because of our attitude after the close of hostilities will make up for their folly, gird themselves and prepare to enact such legislation as will make the development of our water-power possible.

CONSTRUCTION OF COFFERDAMS ON THE SOUTH BANK

TECHNOLOGY MEN AT MUSCLE SHOALS

In pointing out the number of Technology men employed at one time or another at Muscle Shoals, the following loom up in importance:

Stephen L. Coles, '91, was Captain in the Nitrates Division of the Ordnance Department, U. S. A., from January 17, 1918, to January 9, 1919, and was Commanding Officer and Inspector of construction at the United States Nitrate Plant No. 2, Muscle Shoals, Alabama, from March 4 to September 30, 1918. He was later Director of Operations at the United States Nitrate Plant No. 2 from September 30, 1918, to January 9, 1919.

Lewis R. Cobb '86, was a civilian employee of the Westinghouse, Church, Kerr and Co., of New York City. He was employed at Muscle Shoals in connection with work of the above firm and did work at Nitrate Plant No. 2. The work at Muscle Shoals was one of the important engineering jobs performed by that Company, with which several Technology men are connected.

Percival Clow '00, was with the Westinghouse, Church, Kerr and Co., Inc. He helped in preparation of the designs of building construction and the purchase of structural steel for a large volume of the war work, at Nitrate Plant No. 2, near Sheffield, Alabama.

Robert A. Pope '02 was consultant town planner, called in by Ewing and Allen for the work of designing the Nitrate Co.'s town at Muscle Shoals.

William B. Flynn '99 who was also with the Westinghouse, Church, Kerr and Co., Inc., did the same kind of work as others noted above in the employ of the same Company.

C. H. Boylston '08 was Superintendent of Construction on the Steam Plant built by the Nitrates Division of the Ordnance Department in connection with Nitrate Plant No. 2 at Muscle Shoals.

Carl W. Kinston '08 was Chemical Engineer there. His work at Muscle Shoals involved the construction and installation of equipment and starting of the first operations of ammonia gas and ammonium nitrate divisions of the plant. He put up the immense buildings and intricate machinery against all kinds of odds and labor troubles. The time set for operation was November 9, 1918, and he had charge of the starting of the first chemical production of the first synthetic ammonium nitrate made in this country. The first product was turned out on November 7th, and he stayed with the nitrate work until February, 1919.

John J. Elbert '09 assisted in the designing engineering of U. S. Nitrate Plants Nos. 2, 3, and 4, No. 2 being at Muscle Shoals, Alabama.

Many other Technology men associated with E. E. Badger and Sons through them did much work at the Muscle Shoals project. Captain Grant, and other Technology men whose work the writer does not happen to be personally familiar with, is to be connected with the construction of the dam which is now being built to generate power for the operation of the nitrate plant.

Samuel A. Fletcher '01 who has for some years been superintendent of service for the Alabama Power Company held a very responsible executive engineering position during the war in connection with the supply of power for construction purposes at Muscle Shoals.

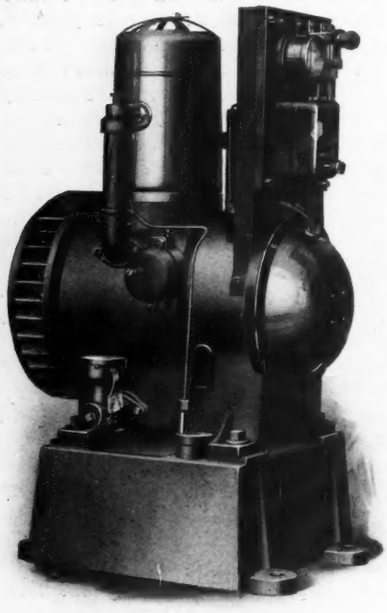
If names have been omitted which should have been in, it is because of our lack of more details of the men in executive positions. Technology promises to continue her work of supplying American industry with trained experts. With her recent endowments from Mr. Eastman and her Alumni, and with her plan of co-operation with the industries, she is bound to assume her place in the world of learning as one of the very finest in existence.

A great part of the credit for the lead which the Institute holds in engineering education may be attributed to one man —the late Dr. Maclaurin. It is simply another example of what one man can do when working with a sincere purpose in mind and when receiving the support of a financial power such as Mr. George Eastman.

THE GRAY & DAVIS LIGHTING PLANT

Lighting plants consist of four fundamental parts,—the power unit, the electrical generator, the cooling system, and the storage battery. In the Gray & Davis plant the first three are combined in one compact substantial unit.

An air cooling system has been found to be the most satisfactory as it is reliable and does away with all troubles from freezing or leaks in a water system. The fly-wheel with its integrally cast vanes creates the air suction for cooling. It is claimed that the Gray & Davis unit provides ample cooling for even the hottest



THE UNIT POWER PLANT

weather and yet will run in zero weather without special attention. The thickness of metal, exposed surfaces, the area of the free air space and the angle of the vanes have all been carefully studied and arranged to meet the requirements of the engine for all conditions. Smoothness of operation, accessibility and interchangeability of parts, economy and simplicity have been the guide posts of design.

The Gray & Davis plant is a complete unit. The dynamo which generates the current for the battery is of the four pole, shunt wound type driven directly thru the crank-shaft of the engine. The capacity of the generator is 350 watts, 32 to 42 volts,—being equivalent to fifteen 20 watt lamps. The battery and generator combined have a capacity equal to 25 lamps.

The piston stroke, valves and camshaft of the engine have been very carefully proportioned, resulting in a marked decrease in the consumption of fuel. The engine is of the single cylinder, four cycle, valve-in-head type with a 2½ inch bore and 2½ inch stroke. The fuel tank is enclosed in the metal base. The unit is selfstarting from the battery.

Any reliable make of storage battery may be used. The battery built to go with the set consists of a glass jar assembly and is sent out fully charged and ready for use.

Word comes of a new molybdenum steel which is far in advance of any speed steel hitherto made. Its discoverer claims that the new steel has far more commercial possibilities than any now in use, that it is unrivaled in hardness, that in tool form it will remove a greater weight than any other steel, and that it possesses comparatively longer life than any other.

Frank R. Field, '89, who has been for the past twenty-three years, manager of the Denver branch office of the Jeffery Manufacturing Co., has left that field of endeavor and has taken up the representation of the same firm's interests in the Southwest with headquarters at 439 Herman W. Hellmar Building, Los Angeles, California.

James M. Barker, '07, recenly left for South America to establish branch offices there of the First National Bank of Boston. He left for Buenos Aires where he will establish the first bank and later will establish one in Rio de Janiero. He will be gone for three or four years. Prior to his service with the bank, Mr. Barker was Assistant Professor of Structural Engineering at the Institue.

Samuel B. Tuell, '03, formerly with Stone & Webster, is now Manager of the Houghton County Electric Light Co., Houghton, Mich. He is a graduate of Course VI and has gained extensive experience in engineering work in his connection with the Stone & Webster organization, having been employed at Key West, Porto Rico, and other places in the South. He was for some time at Pawtivket, R. I., and was later placed in charge of the utility work at Hog Island, later entering the office of vice-president.

E. V. French, '89, has been elected president of the Arkwright Mutual Insurance Co. He has been since 1906, vice-president and engineer. Mr. French joined the inspection department of the Mutual Company in 1892 and was active in many of the inspection and engineering problems of the department from that time until coming to the Arkwright Company. During the war he spent a year in France, as Chief of the Bureau of Fire Prevention, applying such methods as were possible to safeguard the enormous stocks of war materials, the shops, hospitals and other properties of vital importance to the armies.

THE NEXT STEP IN INDUSTRIAL MANAGEMENT

(Continued from Page 1)

where the operations of production were to take place.

The important thing to appreciate at this point is that the operating effectiveness of these men in charge of production was not hampered, but instead, greatly strengthened and improved by these changes. This was because their power and authority to control productive operation were not infringed upon. And here we sense the distinction between operation and maintenance.

The purchasing agent and storekeeper were maintaining the materials and supplies, the engineer the buildings, machinery, equipment and working conditions, the inspector, the quality and the planning department, the methods and schedules of work. The authority for productive operation, was still clearly in the hands of the production executives.

With the coming of the War, it was evident that further functionalization was necessary and personnel work or industrial relations was introduced into industry. As we begin to gain perspective in viewing its advent we see that, again, its prime activity was one of maintenance,—in this case, of labor maintenance.

Among other meritorious activities, the director of personnel strove to recruit and select suitable labor, to guard the health of the employees and protect them from industrial hazards through the introduction of medical assistance, rest rooms, restaurants, and accident prevention. They also aimed to assist them in obtaining living accommodations, to teach them their new work by means of training departments and vestibule schools, to acquaint them with their fellow-workers through athletics, clubs and social organizations and the use of the shop periodical. In general, they tried to *maintain* the employees in an environment which would be conducive towards their best effort.

As we look now upon the production executives, relieved of their tasks of building, machinery, material and labor maintenance, we see clearly that many of the technical responsibilities which are found in industrial work have been taken from their shouders. Their task is now, as we pointed out in the opening paragraph, the converting of material into finished product through the application of mechanical and human forces. But their use of machinery can only be made through their employees. It is obvious that their problem is then to handle men which involves a knowledge of the humanities as well as an understanding of technicalities. In the industries of tomorrow, this will be the sole activity of the production executive.

(Continued on Page 17)

GEORGE ELLERY HALE

By H. M. GOODWIN, PH. D.

Head of Department of Electro-Chemistry, M. I. T.

The many friends of Dr. George E. Hale will be interested to learn of the honor which has just been bestowed upon him by the King of Belgium. At the time of his recent visit to Pasadena, Maeterlinck, together with the Belgian Vice-Consul of Los Angeles, in behalf of King Albert conferred upon Dr. Hale, the decoration of Knight Commander of the Order of Leopold, in recognition of his contributions to Science and of the important work which he accomplished during the War, as Chairman of the National Research Council. Thus one more honor has been added to those which learned societies and academies of the scientific world have honored themselves in bestowing upon Technology's most eminent alumnus, for undoubtedly no other Institute graduate is so well known internationally as Dr. Hale.

Hale was born in Chicago June 29, 1868. He entered the Institute in September 1886 and graduated with the Class of '90 in the Course in Physics. His interest in science dates from boyhood. While yet a student at the Institute he worked out the details of his earliest form of the spectroheliograph, an instrument by means of which solar phenomena can be photographed in the monochromatic light emitted by any element, as hydrogen, iron, calcium etc., which is present in the solar atmosphere. A preliminary trial of this remarkable invention was made by Hale at the Harvard College Observatory in 1890 and the results incorporated in his bachelor's thesis. A little later at his private observatory, the Kenwood Observatory, in Chicago, the first photographs of the sun's disk were obtained with the spectroheliograph and thus opened up a new field of solar research. This instrument has undoubtedly done more to advance our knowledge of the sun than any other since the invention of the spectroscope.

In 1892 Hale was made Professor of Astrophysics at the University of Chicago and later, 1895, largely through his own efforts, the Yerkes 40 inch refractor was constructed and the beautiful Yerkes Observatory at Williams Bay, Wisconsin, was established. As director of this Observatory, 1895-1905, many important researches were carried out, and it was here that his larger program of work bearing on the general problem of Stellar Evolution was developed. The Astrophysical Journal, of which he was Editor, was also established at this time. In 1903 he made an examination of the atmospheric conditions on various mountain tops with the idea of establishing a mountain observatory. Mount Wilson near Pasadena, California, was selected as best fulfilling the conditions desired. Mr. Carnegie and the Trustees of the Carnegie Institution became interested in financing Dr. Hale's proposed plan for establishing a most complete solar observatory on this mountain with an accompanying physical laboratory and instrument shop in Pasadena. Many of the instruments which he and his associates have designed, constructed and transported to the top of Mount Wilson, 6000 ft. high, where they now are in continuous operation, are unique, some differing radically from anything ever before attempted in the way of telescopes. It required courage and faith to venture upon such costly experiments, but in every case the judgment of the director has been vindicated by the results obtained. Among the great telescopes which constitute the equipment of this observatory are the Snow Horizontal Telescope, two tower telescopes, Hale's own invention, 65 and 160 feet high respectively, the great 60 inch reflector and finally the recently mounted Hooker telescope, the mirror of which is 100 inches in diameter. The design and construction of the mounting of the last instrument was an engineering proposition of great magnitude as may be inferred from the fact that, made by the Fore River Shipbuilding Company, the parts were so large that it was necessary to transport them to the Pacific Coast by water instead of rail. The results already obtained with this instrument indicate that its enormous cost will be more than justified by the researches it will make possible; it is estimated that the number of stars revealed by its great light-collecting power will be doubled.

To enumerate Dr. Hale's contributions to astrophysics would be to prepare a catalogue. One discovery, however, deserves particular mention on account of its fundamental importance—namely, the discovery of the Zeeman effect in the spectra of sun spots, thus proving that in the spots there exist powerful magnetic fields, that the spots in fact are great vortices in which electronic charges are moving with high velocity. This is properly regarded as one of the epoch making discoveries of the century.

In recognition of his contributions to science Dr. Hale has been the recipient of many Honorary Degrees; among the medals which he has received may be mentioned the Rumford Medal of the American Academy of Arts and Sciences, the Janssen Medal of the Paris Academy of Sciences, the Draper Medal, the Gold Medal of the Royal Astronomical Society of London, the Bruce Medal of the Astronomical Society of the Pacific and the Janssen Medal of the Astronomical Society of France. He is a member of the leading academies and scientific societies not only in this country but in Europe. The very exceptional distinction of membership in the French Academy was extended to him about a year ago.

With a devotion amounting almost to a passion for his chosen science, astrophysics, Dr. Hale's interest in other fields of scientific research, in literature, art, and music as well as in national affairs is hardly less keen. He is a great scientist, a great organizer, a great leader among men—a son of Technology of whom she may well be proud.

Professor D. L. Webster and Mr. F. C. Hoyt are working on questions arising from the application of the quantum theory of radiation to X-rays. This field of research is of special interest because the quantum theory was developed from the phenomena of radiant heat and when extended to X-rays, at the other end of the spectrum, it predicts some extraordinary effects. Most of these effects actually occur, but in such a way as to show characteristic differences in the atomic mechanisms producing the different rays. The specific problems under investigation are the laws connecting the X-rays with the speed of the cathode rays producing them.

C. C. Smart, '05, has resigned as works manager of the Wells Bros. Co., division of the Greenfield Tap and Die Corporation, Greenfield, Mass., to assume a similar position with W. & L. E. Gurley, Troy, N. Y.

Harry H. Saytor, '02, who has for several years been editor of Country Life in America, recently resigned to become Director of Service for the Atlas Advertising Agency, 450 Fifth Avenue, New York.

Charles Hayden, '90, has been elected director of the Montreal Locomotive Works, Ltd. Mr. Hayden was one of the Committee of Twenty-five named by the Association of Railroad Executives to confer with the Director-General in Washington, to consider railroad labor problems arising out of the relinquishment of government control.

Gerard Swope, '95, was recently awarded a Distinguished Service Medal by Secretary of War, Baker, for his work under Major-General Goethals with whom he was associated as Assistant Director of Purchase, Storage and Traffic. He was largely concerned in planning and executing the reorganization of the Army Supply Service. Mr. Swope is President of the International General Electric Company.

THE MODERN MANUFACTURE OF ROPE

By H. F. HEDBURG '20

The following article describes the present day processes of an industry which, having steadily grown and expanded since the days of hand labor, is now dependent for its success upon the conscientious adherence to advanced scientific principles. It is with the kind assistance of this industry's greatest and foremost exponent, the Plymouth Cordage Company of North Plymouth, Mass., that we are enabled to make the following presentation.

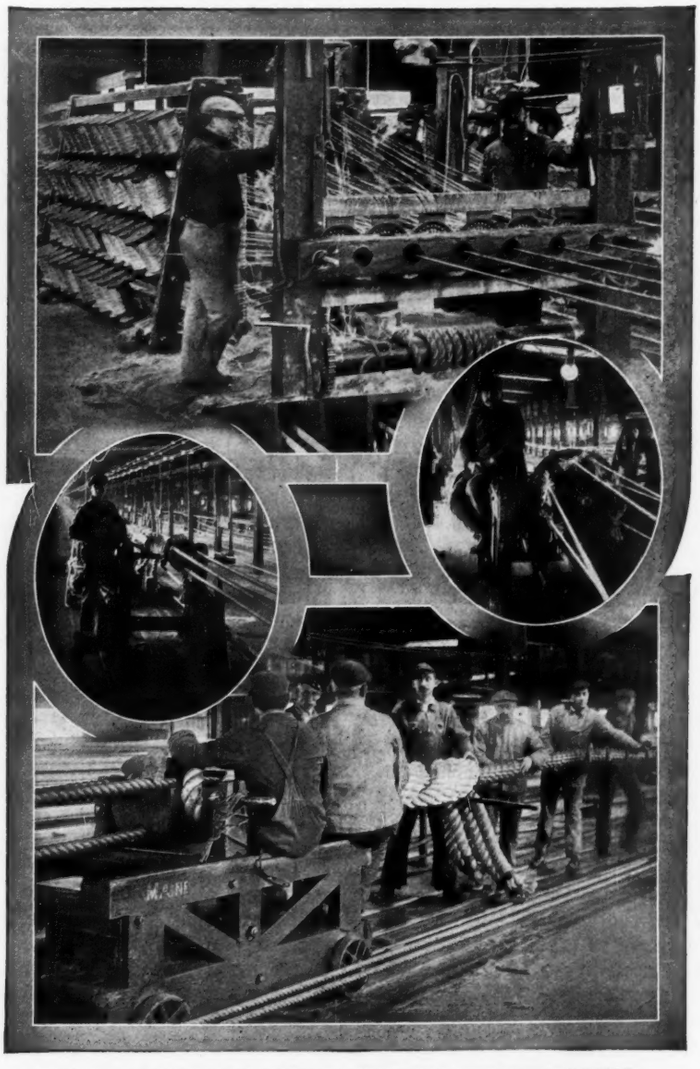
From the fiber plant to the finished rope or cable the utmost care is used in the selection and treatment of raw material. The most excellent material for rope making is the so-called "Manila hemp," which, strictly speaking, is not hemp at all, but a fiber obtained from the wild banana plant of the Philippine Islands. As there are fourteen varieties of this fiber, many of which are unsuited for rope making, extreme care and skill are necessary in selecting the proper material. This fiber called "Abaca" in the Philippines, is used exclusively in the very best ropes, but because of the remoteness of the material and the consequent heavy transportation costs, recourse is had to several other classes of fiber for other than just first class ropes. The chief of these is sisal, which is grown in large quantities in Mexico. The length of the sisal fiber is only from two to four feet, while that of the Manila fiber is from six to ten feet. The tensile strength of the individual fiber is only three-fourths that of the Manila fiber, and it also lacks the gloss and brilliancy characteristic of good quality Manila. Nevertheless, it makes good rope for a myriad of uses where there is not excessive exposure to the elements, for example, in tie ropes for kindling wood, leather, shingles and sacks, and in the binding twine used in the self-binding reapers on the wheatfields of the West.

After the plants have been carefully raised, the fibers are taken and put through various processes of selection and cleaning before being shipped to the rope mills. The degree of care used in these early processes has a decided effect upon the finished product, and considerable difficulty is experienced for their successful prosecution because of the very indolent class of labor found in the countries where these fibers are grown.

Immediately upon arriving at the rope mills the bales are opened and the fiber is again examined minutely, and graded by an expert. At this point begins the actual process of manufacturing rope from the fiber, and anyone familiar with textile manufacturing, will at once notice many resemblances between that industry and rope making.

The hanks of fiber are first oiled somewhat to make them workable and are put through a series of machines preparatory to spinning the fiber into yarn. The usual series of machines consists of a first and second breaker, a coarse and fine spreader, and a draw frame. The purpose of the first breaker is to form the primary sliver or "roping". The hanks of fiber are fed into the machine by hand. Steel pins fitted to a slowly revolving endless chain grasp the mass while a second set of pins moving more rapidly, draws out the individual fibers and combs them into continuous form. The next operations are very similar to this. Several slivers from the first breakers are fed together into a slowly revolving set of pins and drawn out again by a high-speed set into a smaller sliver, the pins becoming finer on each successive machine until the draw frames are reached. The slivers from each machine are successively of more uniform weight, and there is also increasing parallelism among the fibers. In the draw frame the fiber is pulled from a single set of pins between two rapidly moving leather belts called aprons.

The spinning of the last sliver into yarn consists of imparting a certain number of twists per foot of length into the sliver, and at the same time reducing the yarn to a definite size. The drawing takes place between the apron of the spinner and the flyer, which is a capstan revolving at one end of the receiving bobbin. The flyer revolves at a different speed than the bobbin and thereby the



CORDAGE MANUFACTURE BY THE ROPE WALK METHOD

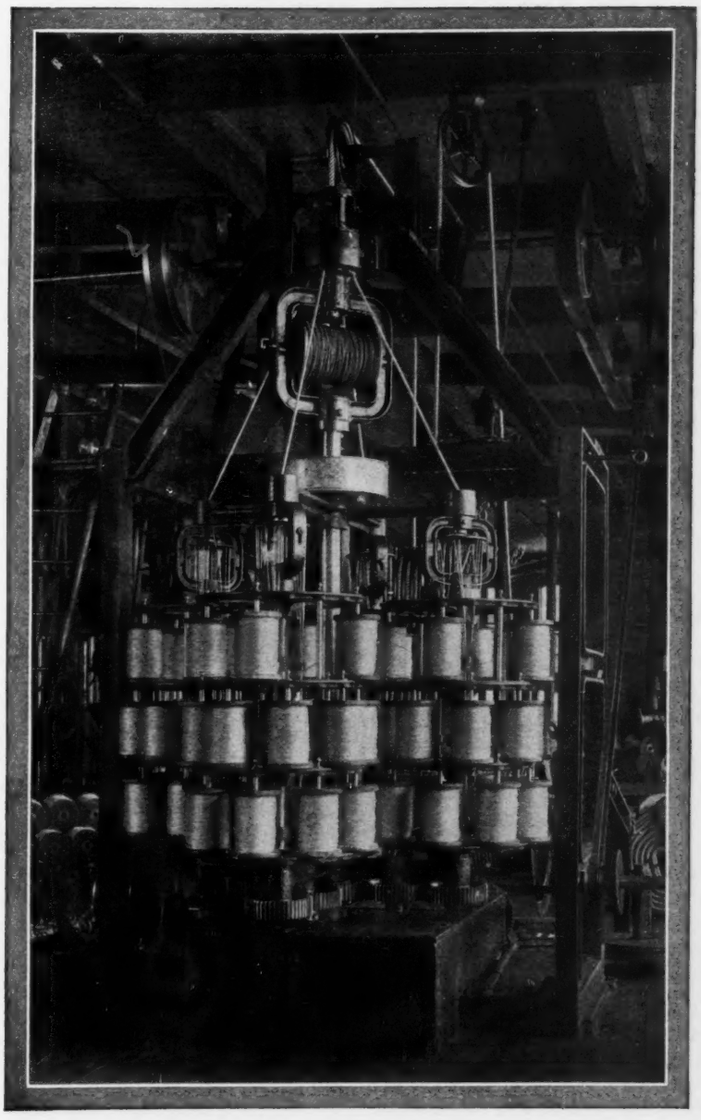
twist is given to the yarn, the amount of twist varying with the relation between the speeds of flyer and bobbin.

Before winding the yarn into strands, a part of it to be used for certain kinds of rope, is tarred by unwinding the yarn from the bobbins and drawing it through a copper lined trough containing tar at a temperature of 200° F or over then pressing out the excess of tar and rewinding on bobbins at the farther end of the trough.

To form the strand of rope, the bobbins of yarn that have come from the spinner are placed upon pins set in a frame. The required number of yarns for the strand to be formed are rove through an iron plate perforated in concentric circles. After passing through the plate they are brought together and enter an iron tube, the diameter of the hole in the tube being the size of rope strand required. The mouth of the tube is countersunk to provide friction on the yarn and prevent the twist from working through the tube.

Ropes are made in two ways, in the factory on what may be termed "house machinery" or in the ropewalk, and are usually designated as machine-laid and walk-laid. On a rope machine the strand, if a stranding machine, (or the rope, if on a laying machine) is reeled up as completed. In a walk, the strand is hauled the length of the walk and supported by stakes.

The machine for forming machine-made rope consists of a flyer carrying capstans which pull the strands through a tube, a reel which takes up the finished strand, and a guide driven on a diamond pointed screw that guides the strand on to the take-up reel. The capstans have many gears by which the turns in the strand are controlled. The take-up reel does not have a position but is driven by friction. The tail bearing of the flyer is drilled for a shaft, and mounted on the outside end of this shaft is a pulley with friction. On the inside end is a gear connected by mitre gears with a fixed gear on the reel. The guide is also driven by a chain of gears from the small gear on the reel. The flyer can be run in either direction to make rope strands right or left turn. In the walk, the strand, after being pulled through the tube, is attached to the forming machine, and the power is transmitted the length of the walk by rope transmission. The forming machine is simply a heavy frame carrying the main shaft and fly (the driven wheel). This has a spreader with an outside rim; whelps are mounted on the arm of the spreader which can be moved in or out, increasing or diminishing the circumference of the fly. The whelps are beveled like a capstan so that the band or transmission rope will surge, and two or three turns of the rope are put around the fly.



FOUR-STRAND COMPOUND LAYING-MACHINE

The head of the machine consists of a shaft with a gear and outside of this gear, and driven from it, usually four large and six smaller gears. On the lower frame of the machine, geared to the main shaft, is mounted the capstan, the diameter of which can be changed to regulate the speed of the machine. The machine is started by throwing the capstan into gear with the main shaft and the machine is parbuckled up the walk along a rope technically called the ground rope.

The capstan is set at such a diameter that while the machine is moving ahead one fathom on the ground rope, the gears on the head of the machine will give the strand the required number of turns. The larger the diameter of the drum, the quicker the travel of the machine. This speed can be controlled by shifting the whelps on the fly or driven pulley, as previously mentioned.

The turn in the rope is technically known as the afterturn; that in the strand, the foreturn. The strands after being formed are twisted into a rope. The principle of rope construction is the contrary turn, that is, the turn in the strand is in one direction, that in the rope opposite, and the two turns acting against each other keep the rope together. Then when the three strands are twisted together into a rope, the turn is thrown out of the strand. Thus it is necessary, if laying rope in the ropewalk, to have two machines, the afterturn machine on which the three strands are attached to one cog, and the foreturn machine at the other end of the walk, on which the three strands are attached to three cogs running in a direction contrary to the afterturn machine.

The strands are hung on the two machines and additional twist is put

(Continued on Page 21)

The Tech Engineering News

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CHEATING

All Technology was recently shocked by the expulsion of men for cheating. There is only one way at an engineering school, to deal with men who do cheat persistently and seem not to be affected by the opinions and actions of fellow students and faculty, they must be requested to leave.

When a student attempts by illegitimate means to pass studies at Yale, at Dartmouth, at Harvard, he is wilfully subverting his character. When a man cheats at Technology, he is doing this and more, he is laying the cornerstone of a life of failure, failure in business, failure in happiness, as well as failure in morals. An engineer cannot be a cheat. No company will hire a man whose integrity is at all questionable. The results to its reputation would be too pitiable to contemplate. Suppose a bridge engineer should fudge some results? If the structure held together, he would be in luck. He would have taken a chance and gotten away with it. But what if it falls? He is a criminal, his company has made a reputation for itself that will require years to live down. Once an engineer is caught cheating, and every man who does it is eventually detected, he is ruined. He is destined to a life of minor positions. Responsibility will pass him by, because it always carries with it the opportunity to cheat employer or client.

No one of course, leaves Technology with a confirmed habit of dishonesty. The worst he can do is get well started on the road. There is no reason however, why he should not be started on the other road. Most men enter the Institute at the most impressionable period of their lives. They are usually away from home for the first time, and their characters are being formed by the men with whom they come in contact.

The solution of the problem is furnished by public opinion, backed by the honor system. No student will cheat if all his fellows frown on the practice and give him the cold shoulder for doing it. He is exceedingly human and gregarious. On his standing with other students depends his social life and so his happiness. It has been conclusively demonstrated at other schools that the honor system is a distinct success. If placed on honor, students will live up to expectations and meet their responsibilities. With monitors pussyfooting up and down the aisles, it requires considerable cleverness to cheat and not be detected. Everything difficult and clever is considered laudable by youth. Cheating at studies should be taken from the position of romantic glamor which it now occupies, and identified as the unsportsmanlike, despicable practise which it is, by a judicious honor system.

ENGINEERS IN POLITICS

The profession of engineering is a comparatively modern one; the church, the teaching profession, medicine, law, all antedate it by hundreds of years. It is impossible to say when there were first engineers, but not until well along in the nineteenth century did the engineer cease to be a master mechanic, a master builder, a master carpenter, and take his proper, recognized place among the professional men.

The reason is not far to seek. As long as a man does hand labor solely or does hand work with a slight admixture of brain work, or even does technical brain work alone, he is not a professional man, and can never receive recognition as such. He merely does what comes before him applying mathematical and physical laws, gaining his results through a manipulation of figures.

In the last few decades, the engineer has lifted himself out of this class. The industrial development of the world has made it possible. This development has forced him to do other things, in direct logical sequence, it is true, but out of what had formerly been considered his sphere. The prominent engineer of today must be an organizer, an administrator, a handler of men, a leader. He must see things broadly and yet not generalize; he must take everything into account and do it quantitatively, not qualitatively. It is just here that his training as an engineer is invaluable. When he builds a bridge or plans a railroad, the lives of hundreds hang on the accuracy of his calculations. If one is doubtful of the present positions of trained engineers, he need only read the occupations of Technology alumni: executive officers of industrial concerns, banks, and merchandising companies; city managers and government department heads.

Now the engineer seems to be going farther than he ever went before. He is entering political life, long held sacred to lawyers, only recently opened to business men, and now beckoning the trained, experienced industrial organizer.

The public has too long conceded to lawyers, college professors and so-called intellectually trained men, all public offices. The people have unhesitatingly elected these men to lead the country in all its ventures. The nation must begin to realize that the man best equipped to do a thing is the man who has had experience in similar undertakings. It is easily demonstrable that men trained as engineers are the executives of the country. No one can appreciate this as engineers can, and it is distinctly the duty of these men to act upon their knowledge. An engineer for president, either at the coming elections or in the not too distant future, seems to be the logical outcome of events.

THE ENGINEERS' HOOVER COMMITTEE

Albert R. Ledoux,
Charles F. Rand,
Joint Chairmen.

To the Engineers of America:

Fellow Craftsmen: None of the undersigned has been active in "politics" heretofore; nor are we now! But we believe that our country needs just one kind of a man to guide its fortunes during the next four years.

He should be a man understanding the underlying causes of the present nation-wide unrest—the economic as well as the social causes; a man who has administered large affairs successfully, handled vast sums economically and honestly; has employed laborers with sympathy and success; one having executive experience; who has made his way up from humble beginnings and therefore understands the psychology of the man who works with his hands; one who has the courage to combat squarely, whether in the boardrooms of heretofore favored corporations or in the councils of ignorant or vicious soviets.

We need a man not only "favoring" economy in the National Administration, but an avowed advocate thereof, with the knowledge gained from experience of how a budget system is prepared and also how it should *work;* in other words, a sane and tried "efficiency expert."

America needs a man who has seen and knows actual conditions over-seas and

who can guide our international relations with firmness and sympathy, justice and honor; a man who has met face to face and understands those who lead the councils and influence the policies of European Nations, new and old; who has had courage to say "No!" when necessary, not only to our late enemies, but to some others abroad who would take advantage of American sympathy or generosity—yes, and to some of the few here who would "profiteer."

Some of us know and respect one or more of the men who are seeking in an honorable way to secure the presidential nomination, and others who are also favorably thought of; *but has anyone of them the first-hand knowledge of our National and International problems that are in the undisputed possession of Herbert Hoover?* We think not!

We believe it possible that he can be nominated, even without a political machine behind him; that the American people can constitute themselves a "Committee of the Whole" whose choice will be triumphant at Chicago in June, *provided the Vox Populi can be made audible*!

How can this be done? By bringing it about that the people shall not only speak out what we believe is in their hearts but that their voice shall be *heard*.

We are members of one or another of the great Engineering Societies of America, but we have neither asked nor do we expect these organizations to act as *such*. But if each of you 100,000 men to whom this letter is sent, will constitute himself a committee of one, each in his own locality, to spread the well known facts of Herbert Hoover's career, personality and attainments and to *bring to the delegates of your own State the knowledge of your neighbors' demand* that he shall be the nominee, this result will surely be attained. No one knows better than the political leaders of all parties that if nominated *he is sure to be elected*.

Will you help to bring this about?

If anyone wishes information or advice as to ways and means he may write to

Engineers' Hoover Committee,

Albert R. Ledoux
Charles F. Rand
Joint Chairmen.

180 Lexington Avenue, N. Y. City.

The following letters have been received in response to a query sent out by The Tech Engineering News on the general employment situation in industry as it affects the Technology graduates. These comments are all from men in a position to know what the conditions are, and all are very much to the point.

Editor, The Tech Engineering News,

Sir: I appreciate very much the invitation contained in your letter of April 2nd to say a few words through the columns of your paper to the men who are about to start out on their career. In my work I find that almost without exception managers are looking for young men who possess not only engineering education but above all who are still able and willing to learn the practical lessons which can only be learned through hard work.

There is a growing recognition of the desirability of employing technically trained men to fill supervisory and managerial positions in branches of industry many of which have not in the past been thought of as calling for such training, and there is on the part of many managers a predisposition in favor of the college graduate on account of his broader outlook upon industrial and business problems, his greater ambition and sense of loyalty to the interests of his employer. On the other hand, however, many managers express dissatisfaction with college trained men on account of the fact that they have in past, in too many cases, shown a disinclination to start at the bottom and to go through with the long hard drill necessary to the acquisition of practical experience so essential as a complement to the training they have received in college.

The value of this practical experience can not be overestimated, painful though its acquisition may be. It is the only way that one can acquire the intimate knowledge of all of the details of the processes of manufacture and the knowledge of men and their viewpoints which one must have if he is to successfully handle them from a position in authority. The most successful managers in the older large businesses will be found to be men who have come up "through the mill" and who are successful by reason of their practical experience perhaps more than anything else.

My message boils down to this—

1. Do not lose time in deciding what line of industry you want to engage in, and do not change about from one thing to another.

2. Once you have selected the line of industry you want to take up forget that you are a college graduate and start in as a workman placing yourself on his plane and if conditions permit live among workmen making whatever financial and social sacrifices that may be necessary to acquire in this way a thorough knowledge of all the details of the business. Adopt the attitude that you have much to learn—even the humblest workman can teach you things you ought to know.

3. During your period of practical training religiously observe all of the rules and regulations by which workmen in the plant are governed and do not ask for nor accept any special privileges. For every dollar of wages you receive try to give not less than two dollars worth of service; in other words strive to be better than the average.

4. Let your immediate goal be to become a foreman and after that you need not worry about your progress.

In following the course I have suggested you will naturally be obliged to make many sacrifices but they will be made at the time of life when you can best afford to make them and while your progress at the start may seem slow you will more than make up for any apparent loss later on. Bear in mind that to rise one must be at least a little better than the average.—Sincerely yours,

H. K. Hathaway.
Consulting Engineer.

Editor, The Tech Engineering News,
Sir:

That the engineer, through his connection with productive industry, is to serve society in a broader sense than ever before is a fact which is becoming more recognized every day. Probably no branch of engineering is so well fitted to serve society as the industrial engineer. Taking away all the detail of this branch of the profession, we find the true purpose of the industrial engineer is to increase production and lower the cost of production. Whenever an article necessary to life and comfort is produced at a lower cost its distribution and production is increased. In direct ratio to this decrease in cost and increase in distribution of the products of the industry which serve for the subsistence and comfort of mankind, does civilization progress. Therefore, the young engineering graduate who desires to affiliate himself with a branch of the engineering profession which will be close to the heart of the present idea of social progress should consider professional industrial engineering.

This profession, like all others, demands considerable experience in actual industry. There are two direct methods of obtaining this experience:— first, through a practical manufacturing experience as a basis for stepping practically prepared into professional work; and secondly, direct experience with a professional, industrial engineering organization. The first method is probably the surer, although the latter affords good possibilities of development. There is also at the present time a great scarcity of trained accountants, a specialized branch of industrial engineering which should be recruited from the ranks of engineers.

The Cooley & Marvin Co. with headquarters at Boston, will probably be in a position to offer an opportunity to several graduates of Technology in June for training, either in direct industrial engineering or in cost accounting. Prospective graduates will be welcome at their offices at any time.

Sincerely yours,

Carle M. Bigelow,
Cooley & Marvin Co.

Editor, The Tech Engineering News,
Sir:

It is hard to lay too great emphasis upon the desirability of men entering employment after years of preparation selecting the proper work to start. The nature of the employment sought, must naturally follow the lines of personal preference, as men will unquestionably be most successful in the lines of endeavor for which a strong personal preference exists.

Having made the choice, however, it is essential that a man makes a start with the right understanding. The world's business to-day is conducted by specialists. Men who have a deep and profound knowledge of the intricacies of their calling, and this knowledge only can be obtained by the ability to start things at the beginning. The man who has had the advantage of education must supplement that education by a practical and detail knowledge of the undertaking in which he desires to engage.

The time to gain the detail knowledge is at the point in a man's life when his earning power is at the lowest, and he can best afford to accept the compensation incidental to a thorough training.

The need of industry for trained men is great, but this training to be of real value must be supplemented by practical knowledge of an industry. In the automotive industry the Packard Motor Car

Company offers training to men of both technical and business education, that will fit them to hold in future years, high positions in the industry.

This training consists of an Advanced Training Course of 104 weeks duration. There are two courses offered, one to the man ambitious to succeed through the medium of the factory, and the other to the man whose inclinations are along office lines. Both of these courses are the same for the first half year, and ground a man thoroughly in the shop practices of the automotive industry. At the completion of the courses, a man of ability is in direct line for advancement, and the success of the individual will naturally depend upon personal ability. These courses not only provide for the proper training of the man entering the industry, but at the same time afford sufficient compensation to maintain the apprentice independently.

In closing I want to lay emphasis on the fact that the young man in starting out should seek in his first employment, definite practical knowledge, in accordance with a well laid plan, of the occupation which he wishes to follow. Many college men arrive at middle age seeking experience. Their past industrial life shows a record of one job after another taken with the idea of obtaining experience. Through long years of study the habit of doing everything for experience has been formed. The keynote of successful business is giving service. Any man of ordinary ability who takes a position with a concern large enough to pay for a full measure of success when it is achieved, and who will start at the bottom and attack each job from a standpoint of giving to the Company a maximum output cannot fail to succeed, but the man who takes one job after another, looking for experience finds himself in middle life with his success still to be achieved.—Sincerely yours,

D. G. Stanbrough,
General Superintedent
Packard Motor Car Co.

Editor, The Tech Engineering News
Sir:

Dear Sir: The opportunities for technically trained men in industry are today more numerous than ever before. The manufacturing industry needs men of analytic ability to study the increasingly complex details of its business and get at the facts upon which it must base its manufacturing policies. The problems confronting the manufacturers are capable of scientific analysis and solution by much the same methods that a student uses on approaching and solving a problem in chemistry, physics or applied mechanics. Technically trained men, regardless of the particular subjects in which they may have specialized in college or university, are particularly well adapted for this work and to bear this out we mention the following positions in our organization now successfully filled by Tech graduates.

Chief Accountant, Graduate 1902, Electrical Engineering.

Comptroller, Graduate 1903, Electrical Engineering.

Assistant Manager, Sales Department, Graduate 1907, Civil Engineering.

Manager Sole Leather Factory, Graduate 1907, Naval Architecture.

Employment Manager, Graduate 1908, Civil Engineering.

Conveyor Factory Engineer, Graduate 1910, Mining Engineering.

Manager, Planning Department, Wholesale Warehouses, Graduate 1911, Sanitary Engineering.

Manager Plant Department, Graduate 1911, Mechanical Engineering.

Assistant Superintendent Chemical Factory, Graduate 1911, Chemical Engineering.

Assistant Superintendent, Shoe Factory, Graduate 1917, Business Administration.

Assistant Superintendent Shoe Factory, Graduate 1917, Business Administration.

In addition to these, twenty other graduates have, during the last fifteen years, successfully filled positions in our organization which were stepping stones to larger opportunities elsewhere.

A Tech graduate, during his first year in industry, is confronted with an amazing amount of detail regarding manufacturing processes and the system required to operate a large industrial enterprise. He is like a post-graduate in a new school and to his employer is little more than an investment upon which he may receive returns in future years.

The W. H. McElwain Company has each year taken into its employ a few graduates of colleges or technical schools and for those men who are willing to work and can afford a "post graduate" year at a moderate salary, it offers the same opportunity for advancement that was given to the men from Tech and other colleges who have already preceded them.

Very truly yours,
W. H. McElwain Company
Winfield L. Shaw
Vice-President.

Editor, The Tech Engineering News
Sir:

The general employment situation at the present time is acute as far as technical men are concerned, there undoubtedly being a demand for well qualified engineers and chemists far exceeding the supply. Judging from this, there should be an excellent opportunity for graduates from an institution of the standing of the Massachusetts Institute of Technology.

The young man fresh from college is, of course, in practically the same position as the graduate in medicine without hospital experience, and this fact is recognized by some large corporations which maintain thoroughly equipped training schools.

As far as the duPont Company is concerned, it is safe to say that there is a continuous demand throughout the year for young chemists and chemical engineers, but it is impossible to state at this time with any degree of accuracy just what the requirements will be in the future. As a matter of policy it is considered best to employ young men of marked ability and promise, at first in comparatively minor positions, promoting these to more important work when the occasion arises, thus maintaining a steady source of supply to the Company's personnel and affording frequent opportunity for promotion. No general training school for technical men is maintained, but it may be seen from the foregoing that there is in effect such a division in the Company.

It may be well to note that there is now a great demand for draftsmen of all descriptions throughout the country, and the opportunities, therefore, in that line of work are very great. It is self-evident that a thorough practical knowledge in design is best gained on the drafting board, the experience acquired thereby being of the greatest value in practically any industry.

Sincerely yours,
J. H. Squires.

DR. KEYES WORKING ON HELIUM

In the Research laboratory of physical-chemistry of the Department of Physics, under Dr. F. G. Keyes experiments are being conducted on the process for extracting helium from natural gas wells. The Institute has entered into contract with the Government to undertake this research.

The process involves the liquifaction of the nitrogen, methane gas, and hydrocarbonates occurring with the helium in the natural gases, leaving helium to pass off as a gas. A knowledge of the thermodynamic properties of gas mixtures is required for the designing and controlling of the rectifying contrivance as well as for the successful operation of the gas liquifiers.

The contract with the Institute is for the purpose of measuring and determining these properties. Since these measurements are usually made at temperatures as low as that of liquid air, the process is an extremely delicate and difficult one, involving the use of composition-pressure diagrams for the various binary mixtures, and the determination of specific heats, and of heats of evaporation. For this work a well equipped laboratory is necessary.

Parallel investigations are being carried on by the Bureau of Standards.

DEPARTMENT OF MINING ENGINEERING AND METALLURGY DOING RESEARCH WORK FOR OUTSIDE PARTIES

Due to the confidential nature of research work conducted in the laboratories of the Department of Mining Engineering and Metallurgy details of the work cannot be given, but the following is being undertaken in this department:

1. Recovery of silver by amalgamation from a refractory ore.
2. Improvements in the preparation of abrasive materials for sandpapers.
3. The recovery of values from electrodes used in furnaces.
4. Recovery of nickel, alumina, and manganese dioxide from Cuban iron ores.
5. Recovery of potash and alumina from slate.
6. Manufacture of sodium hydrosulphate by use of liquid sulphur dioxide.
7. Extraction of copper from pyrite cinder followed by electrodeposition.

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To be admitted to the Institute, the applicant must have attained the age of seventeen years and must pass examinations in Algebra, Plane and Solid Geometry, Physics, History of the United States (or Ancient History), Trigonometry, English, French and German. Preparation in two of a series of elective subjects is also required. A division of these examinations between different examination periods is allowed. In general, a faithful student who has passed creditably through a good high school, having two years' study of French and German (or three years of French or German) should be able to pass the Institute examinations.

Graduates of colleges, and in general all applicants presenting certificates representing work done at other colleges, are excused from the usual entrance examinations and from any subjects already satisfactorily completed. Records of the College Entrance Examination Board, which holds examinations at many points throughout the country and in Europe, are also accepted for admission to the Institute.

Instruction is given by means of lectures and recitations, in connection with appropriate work in the laboratory, drawing-room or field. To this end, extensive laboratories of Chemistry, Physics, Biology, Mining, Mechanical Engineering, Applied Mechanics, and the Mechanic Arts have been thoroughly equipped, and unusual opportunities for field-work and for the examination of existing structures and industries have been secured. So far as is practicable, instruction is given personally to small sections rather than by lectures to large bodies of students.

The regular courses are of four years' duration, and lead to the degree of Bachelor of Science. In most courses the work may also be distributed over five years by students who prefer to do so. Special students are admitted to work for which they are qualified; and the degree of Master of Science, Doctor of Philosophy, and Doctor of Science are given for resident study subsequent to graduation. Opportunity for research is offered in all the departmental laboratories, in the three recently established Research Laboratories of Applied Chemistry and Physical Chemistry, and in the Sanitary Research Laboratory and Sewerage Experiment Station.

The tuition fee, not including breakage in the laboratories, is $250 a year ($300 next year and thereafter). In addition, $40 to $50 per year is required for books and drawing materials.

For catalogues and information, address

PROFESSOR ALLYNE L. MERRILL, Secretary of the Faculty,
Massachusetts Institute of Technology,
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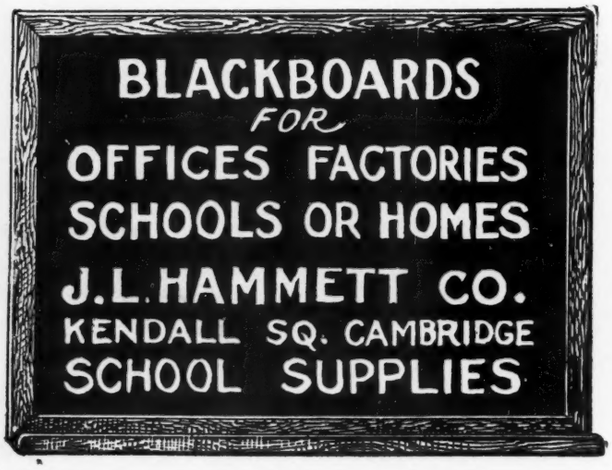

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CURRENT ARTICLES OF INTEREST

A list is given below of articles appearing in current numbers of various periodicals which the editors believe would be to the interest of men in the different courses. When not specified otherwise, magazines in which these articles appear will be found in the Central Library.

COURSE I.

Three Double-Leaf Bascule Bridges at Seattle, Wash. ENGINEERING NEWS RECORD, April 8, p.p. 718-722. Spans have live-load bearings beyond trunnions. Erected in horizontal position. Library, Rm. 1-290.

Hudson Vehicle Tunnel Discussed by Gen. Geothals. ENGINEERING NEWS RECORD, April 8, pp. 729-732. Library. Rm. 1-290.

Design Details and Field Methods on Thin Arch Dam. ENGINEERING NEWS RECORD, March 4, pp. 474-476. Straddling trestle method used. Contraction joints used.

COURSE II.

How Precision Gage-Blocks Are Made. MACHINERY, April, pp. 697-702. A complete description covering every essential detail in their manufacture.

Making Seamless Brass Tubes. THE IRON AGE, April 15, pp. 1087-1092. A summary of previous articles and a description of prevalent processes.

Accelerating Cylinder Production. THE FOUNDRY, April 15, pp. 311-318. Up-to-date methods of casting automobile cylinders. Library, Rm. 8-409.

COURSE III.

The Present Status of the Stamp Mill. ENGINEERING & MINING JOURNAL, April 10, pp. 833-836. The method by which three-fourths of the world's gold ore is crushed. Library Rm. 8-409.

Sulphatizing Roasting of Basic Mill Tailings, ENGINEERING & MINING JOURNAL, April 10, pp. 869-873. Library, Rm. 8-409.

A Pack Train of Eagles, ENGINEERING & MINING JOURNAL, April 17, pp. 920-923. Use of aircraft in mining operations. Library, Rm. 8-409.

COURSE VI

The Modern Trend of Hydro-Electric Engineering, ELECTRICAL WORLD, March 20, pp. 651-653. One of several interesting articles on power development in this issue. Vail library.

The Baldwin-Westinghouse Chicago, Milwaukee & St. Paul Electric Locomotives, JOURNAL OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERING, April, pp. 331-341. Vail library.

Passenger Locomotives for Chicago, Milwaukee & St. Paul Railway, JOURNAL OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, April, pp. 342-345. A description of latest gear-

less type electric locomotive. Vail library.

Preparation of Nitrogen Hydrogen Mixture by Decomposition of Ammonia, JOURNAL OF INDUSTRIAL & ENGINEERING CHEMISTRY, April, pp. 316-317.

The Fixation of Atmospheric Nitrogen by the Silent Electric Discharge Process, JOURNAL OF THE AMERICAN INSTITUTE OF ELECTRICAL ENGINEERS, April, pp. 405-415. Vail library.

COURSE XIII

Add Interior Braces and Stirrups to Concrete Tankers, ENGINEERING NEWS RECORD, April 8, pp. 707-708. Weaknesses revealed by test of government ships corrected by strengthening hull after concrete had been placed. Library, Rm. 1-290.

COURSE XV

Report of the Industrial Conference Called by the President, THE SURVEY, Vol. XLIII, No. 22, March 6. Library, Rm. 1-290.

Taft, Hughes and Hoover on Collective Bargaining, INDUSTRIAL MANAGEMENT, February. Library, Rm. 1-290.

THE NEXT STEP IN INDUSTRIAL MANAGEMENT

(Continued from Page 8)

To teach the handling of men is the next step in industrial management, and it is an activity that is susceptible of education. We must take the art of management out of the realm of intuition and view it in the light of reasoning and with the confidence that underlying principles and laws may be found and utilized as in any other branch of human endeavor.

We do not have to be psychologists to appreciate that in every person there are normal desires which ask outlet in their daily work. There is in all of us a sense of justice which asks satisfaction, a desire to protect and improve the standard of life of those who are dependent upon us, a desire for self-expression, to create, a desire to be with others, an impulse to play, a wish to learn, a liking for work under an able leader.

Providing means for the satisfaction of these normal wants in industry is one of the tasks of man-management and if the production executive is familiar with these impulses, he can interpret his management problems far more easily and solve them in a vastly more effective way.

It is possible to list the important prerequisites to manaı erial ability, as well as characteristics which may be developed through training and which are essential to successful methods of administration. We can also indicate definite methods of procedure whereby those qualifications can be developed.

And lastly, it is entirely practicable in any one industry to develop an assemblage of standards of administrative procedure which will be of great concrete value to the executive organization. For example, in any one plant there are ways of introducing the new employee, of extending praise and commendation, of administering rebuke or criticism, of announcing dismissal, of developing loyalty, of arousing incentive, of developing esprit and morale which have been proven to be exceptionally effective and which successful executives perhaps unconsciously act upon. There are best ways of quieting anger, of removing jealousies, of dispelling imagined wrongs, of capitalizing conceit, of inspiring manliness, courage and self-respect which should be made the subject of round table discussions in the executive organization. The administrators will thus indirectly accomplish another great step in that they will face their problems of management in a restoring rather than an intuitive way and will begin to *think* about handling men.

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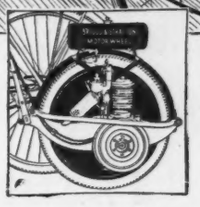

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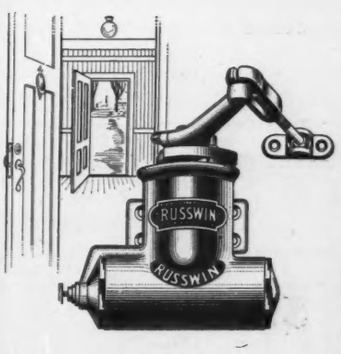

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(Continued from Page 1)

freight and passenger traffic, to the end that there should be furnished to the war industries the greatest possible amounts of energy and fuels. As a result the output of electrical energy exceeded all previous records. And yet during the year following the signing of the armistice the maximum monthly output of electrical power exceeded by 10 per cent that of the record-breaking month of the war.

Energy must be obtained either from fuels (coal or oil) or from falling water. Other possible sources are insufficient and unsatisfactory in amount and availability by present methods of recovery. The increased demand must be met by increased drains on our fuel supplies, by greater development of our water-power resources, or by greater efficiency in the use of power from both sources. But the supply of cheap steaming coal in the Appalachian region is sharply limited. The two principal producing fields are being rapidly exhausted. It is estimated that, at the present rates of removal, the thick beds (the cheap coal) of the Pittsburgh field will be worked out in about 30 years ,and those of the Pocahontas field in 75 years. The rate of production is, however, still increasing, and the end may be reached sooner.

As the exhaustion of cheap coal from the Appalachian fields progresses the price will of course increase. The coal that must be used in increasing quantities to supplement the decreasing supply will be brought from fields situated farther west. It will be of poorer quality and will not be cheap, as the cost of transportation from the Middle West to the Atlantic seaboard must be added to

the cost of mining. What will be the result? Will the industries of the East migrate to the deposits of cheap fuels, taking the experienced workman with them? The effects of the exhaustion of the cheap fuels of the East will surely be country-wide. It is here that our factories and industrial cities have been built, that our skilled workmen have their homes, that our transportation systems have been developed, and that our manufactured goods are now put in final shape for ocean shipment in the world's commerce. These conditions can not be changed quickly, for they involve the industrial fabric of the whole nation and changes in them will involve changes of adjustment extending from the Atlantic to the Pacific and from Canada to the Gulf.

The proposed super-power system will promote the conservation of the fuel supply in three ways. It will assist in increasing the amount of power obtained from the fuels consumed, in increasing efficiency in the use of power, and in making feasible the development of many water-power sites. The immediate effects of the construction of the super-system and the connection therewith of the principal power-producing and power-consuming plants of the region will be the transfer of the base load from inefficient power plants, the construction of new water-power plants, the electrification of trunk-line railroads, the removal of a large percentage of coal freight from the railroads, and the increase in dependability of a cheap supply of power for the industries of the region. The remote and ultimately the more important effect will be the conservation of the excellent steaming coals of the Appalachian fields.

The interconnection of systems will decrease future investments in producing power plants by decreasing the quantity of stand-by capacity needed and by improving the load factor through the greater diversity of power use on the larger system. The development of many water-power sites is not now practicable because of the necessity for constructing large stand-by steam plants to furnish power during the low-water season. The interconnection of power plants on many streams having different regimens will decrease the total steam capacity required, which may be largely furnished by existing modern steam plants.

That the interconnection of systems has much to commend it has been long affirmed by progressing engineers. The public, however, has been slow to grasp its economic importance and has been fearful of dominance by the moneyed interests represented in a unified control. The necessity of a cheap and dependable supply of energy to the nation's industries and to national and international commerce is now so apparent that such developments can not be greatly delayed.

P 2-2½

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They must, however, be so controlled that public interests will be amply protected.

If a dependable supply of cheap power is made available the electrification of the railroads will be hastened, and eventually relatively few modern, efficient central stations will be substituted for many steam locomotives, each of which is a small, inefficient power plant. The electric locomotive draws from the central station only the energy it needs to move its load; when it stops the flow of energy stops. The steam locomotive, on the other hand, consumes coal from the time the fire is started on its grate until it returns to the roundhouse at the end of its run. In an article entitled "The Last Stand of the Reciprocating Steam Engine," appearing in the General Electric Review of February 20, 1920, A. H. Armstrong estimates that the electrification of the present railroads of the country would result in the saving of 122 million tons of coal, or nearly 70 per cent of the 176 million tons now used in transportation. This estimated saving is made up of two items—the coal now burned in hauling coal for use in locomotives and the excess coal consumed in generating power in inefficient locomotives over the coal needed to generate the same amount of power in efficient central stations.

The United States has within her borders a wonderful combination of raw materials. If her resources are developed, her industrial supremacy will be assured.

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THE MODERN MANUFACTURE OF ROPE

(Continued from Page 11)

into the strand, for rope required for different purposes requires different degrees of twist and the more twist the firmer the lay. After the rope has been hardened, the top truck, a four-wheel truck which carries the top and tails, is pushed up to the machine. The top is a wooden cone with three grooves equally spaced to hold the three strands of the rope. The machine is then started and the twist of the rope forces the top and top truck ahead. After it is about a fathom away from the machine, it is stopped and the tails, pieces of old rope of the proper size are wound around in the outline of the rope to be laid. This puts a finish on the rope and enables the rope maker to twist up on these tails and obtain a friction on the rope, and so round it up until the strands lie at the proper angle. For every turn in the rope which forces the top ahead, a corresponding turn is thrown out of the strand. This is replaced in the individual strands by the foreturn machine at the other end of the walk. If the rope maker maintains proper friction on the tails and the angle of the strand in the rope is kept the same, the machines are then throwing turn for turn and the result is a well-laid rope. This same result is obtained on rope machines by having one large flyer with capstans which pull the rope through the rope tube, the take-up reel with friction, and the guide, as described, in the flyer of the forming machine. Each strand of the rope is wound on a reel and each of these three reels revolves on its own axis and in an opposite direction to the rope flyer. By means of changed gears, the turn in the strand is made as hard or as soft as desired and the same results obtained with much less floor space than in laying a rope in the walk.

As to the relative merits of walk-laid and machine-laid rope, the Plymouth Cordage Company considers one as good as the other, but the very largest ropes are usually walk-laid in order to avoid the necessity of using machines of special design.

A scientist of Norway has discovered a way of using great quantities of the white marble-like rock which is abundant in the northwestern part of that country. By the use of nitric acid and a process of evaporation aluminum is obtained from the rock. The process may materially increase the supply of that material, and most surely seems full of promise for that country.

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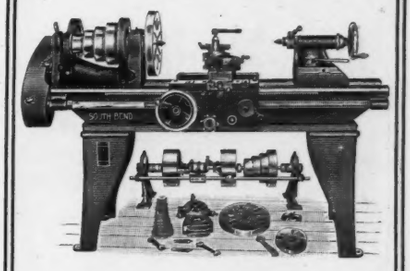

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1920

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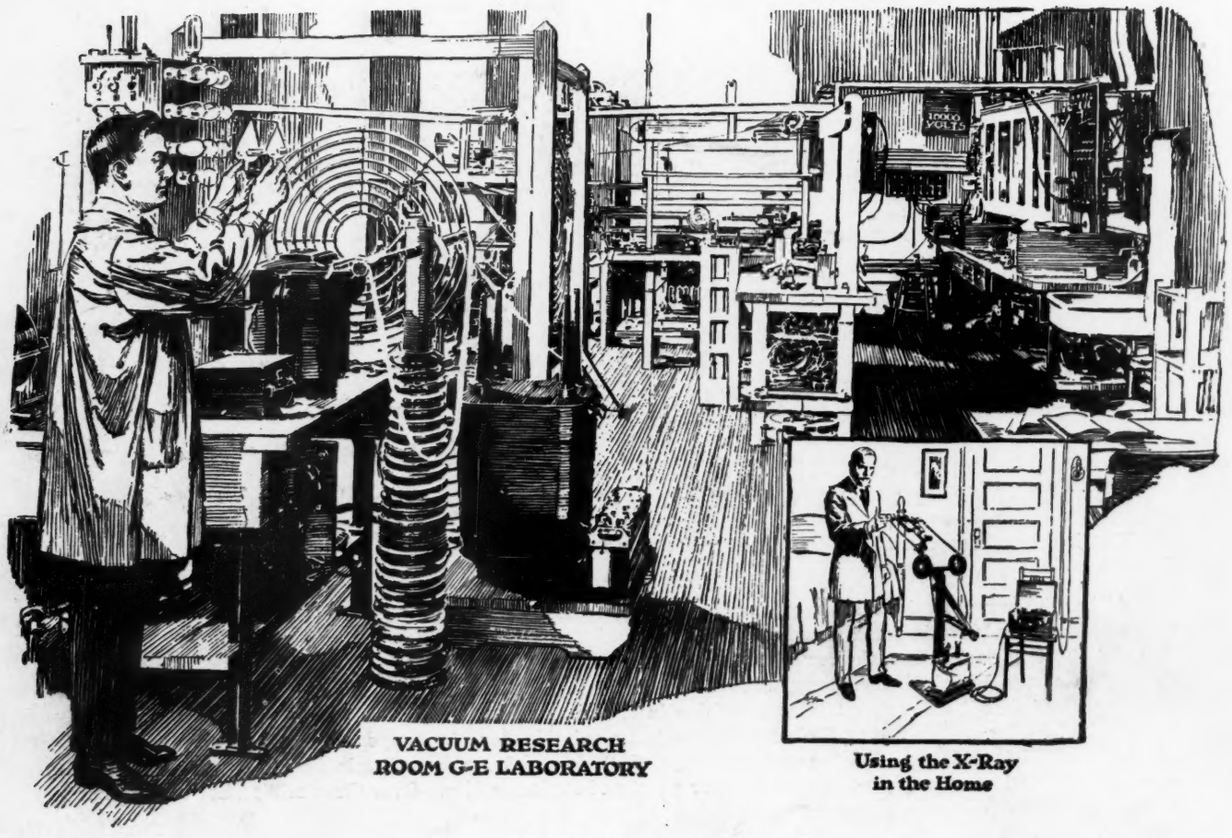

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